

CLAIMS

What is claimed is:

- 1 A thermosetting resin composition with low specific gravity comprising:
 - 5 between 1 and 30 wt% of unsaturated polyester-based resin;
 - between 0.5 and 15 wt% of one selected from saturated crystalline polyester resin serving as a thickener as well as a low profile agent, unsaturated crystalline polyester resin as a thickener, or a mixture of these;
 - 10 between 1 and 15 wt% of a filler with low specific gravity;
 - between 10 and 50 wt% of an inorganic filler;
 - between 15 and 45 wt% of a fiber-type reinforcing agent;
 - between 0.5 and 35 wt% of a monomer;
 - between 0.01 and 2 wt% of an initiator;
 - between 0.1 and 5 wt% of a parting agent; and
 - 15 between 0.01 and 5 wt% of additives.
2. The composition of claim 1 wherein the unsaturated polyester resin is one or a mixture of more than two selected from the group consisting of iso-based resin, ortho-based resin, tere-based resin, modified bisphenol-based resin, and vinyl ester-based resin.
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3. The composition of claim 1 wherein the saturated crystalline polyester resin contains between 1 and 20 wt% of a low profile agent selected from the group consisting of polymethyl methacrylate, polyvinyl acetate, polyurethane, polystyrene, and polystyrene-based copolymer.
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4. The composition of claim 1 wherein the filler with low specific gravity is a glass sphere which is hollow inside.
- 30 5. The composition of claim 1 wherein the inorganic filler is one or a mixture of more than two selected from the group consisting of calcium carbonate, mica, talc and clay.

6. The composition of claim 1 wherein the low profile agent is selected from the group consisting of polymethyl methacrylate, polyvinyl acetate, polyurethane, polystyrene, and polystyrene-based copolymer.

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7. The composition of claim 1 wherein the fiber-type reinforcing agent is glass fiber of 0.64-5.08 mm in length.

8. The composition of claim 1 wherein the monomer is selected from the
10 group consisting of styrene, methyl methacrylate, divinyl benzene, α -methyl
styrene, vinyl acetate and acrylate.

9. The composition of claim 1 wherein the initiator is selected from the
15 group consisting of peroxy ester, dialkyl peroxide, alkyl aryl peroxide, diaryl
peroxide, peroxy ketal, ketone peroxide, and an azo compound.

10. The composition of claim 1 wherein the parting agent is zinc stearate or
calcium stearate.

20 11. The composition of claim 1 wherein the additives are one or a mixture
of more than two selected from the group consisting of a pigment, a heat
stabilizer, a UV stabilizer and a polymerization inhibitor.

12. A method of manufacturing a thermosetting resin composition with
25 low specific gravity comprising:

forming a reaction composition by admixing

-between 1 and 30 wt% of unsaturated polyester-based resin;

-between 0.5 and 15 wt% of one selected from saturated
crystalline polyester resin serving as a thickener as well as a low profile agent,
30 unsaturated crystalline polyester resin as a thickener, and a mixture of these;

-between 1 and 15 wt% of a filler with low specific gravity;

-between 10 and 50 wt% of an inorganic filler;

- PCT/EP2017/063007
- between 15 and 45 wt% of a fiber-type reinforcing agent;
 - between 0.5 and 35 wt% of a monomer;
 - between 0.01 and 2 wt% of an initiator;
 - between 0.1 and 5 wt% of a parting agent; and
 - between 0.01 and 5 wt% of additives; and
- 5 reacting the reaction composition to form a composite.
13. The method of claim 12 wherein the saturated crystalline polyester resin contains between 1 and 20 wt% of a low profile agent selected from the group consisting of polymethyl methacrylate, polyvinyl acetate, polyurethane, polystyrene, and polystyrene-based copolymer.
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14. A car panel formed from thermosetting resin composition consisting essentially of:
- 15 between 1 and 30 wt% of unsaturated polyester-based resin;
- between 0.5 and 15 wt% of one selected from saturated crystalline polyester resin serving as a thickener as well as a low profile agent, unsaturated crystalline polyester resin as a thickener, or a mixture of these;
- between 1 and 15 wt% of a first inorganic filler with a specific gravity of
- 20 less than about 1.5;
- between 10 and 50 wt% of a second inorganic filler;
- between 15 and 45 wt% of a fiber-type reinforcing agent;
- between 0.5 and 35 wt% of a low molecular weight polymerizable compound;
- 25 between 0.01 and 2 wt% of an initiator;
- between 0.01 and 5 wt% of additives; and
- between 0.1 and 5 wt% of a parting agent, wherein the composition is reacted to form a thermosetting composite which is formed into a car panel
- 30 15. The car panel of claim 14 wherein
- the unsaturated polyester-based resin comprises iso-based resin, ortho-based resin, tere-based resin, modified bisphenol-based resin, vinyl ester-based

resin, or a mixture thereof;

the saturated crystalline comprises between 1 and 20 wt% of polymethyl methacrylate, polyvinyl acetate, polyurethane, polystyrene, and polystyrene-based copolymer;

5 the first inorganic filler comprises hollow spheres, hollow fibers, hollow glass objects, or a mixture thereof with a specific gravity of between 0.1 and about 0.6 g/cc.;

 the second inorganic filler comprises calcium carbonate, mica, talc and clay; and

10 the low molecular weight polymerizable compound comprises a monomer, dimer, or mixture thereof.

16. The car panel of claim 14 wherein the first inorganic filler has a specific gravity of about 0.1 to about 0.8, and wherein the bulk density of the reacted 15 composition is between about 1.3 and 1.7.

17. The car panel of claim 14 wherein the first inorganic filler has a specific gravity of between about 0.1 and 0.6, and wherein the bulk density of the reacted composition is between about 1.75 and 1.95

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18. The car panel of claim 14 wherein

 the first inorganic filler comprises hollow glass spheres that have a specific gravity of between about 0.1 and 0.8;

25 the low molecular weight polymerizable compound comprises monomers of styrene, methyl methacrylate, divinyl benzene, α -methyl styrene, vinyl acetate, acrylate, or mixtures thereof;

 the second inorganic filler comprises calcium carbonate, mica, talc and clay; and

30 the fiber-type reinforcing agent consists of glass fibers with a length less than about 10 mm in length present in amount between 20 and 35 wt%; wherein the bulk density of the reacted composition is between about 1.3 and about 1.75.

19. A sheet molding compound process for forming a formed product comprising:

providing a composite sheet formed from a composition comprising
5 between 1 and 30 wt% of unsaturated polyester-based resin, between 0.5 and 15
wt% of one selected from saturated crystalline polyester resin serving as a
thickener as well as a low profile agent, unsaturated crystalline polyester resin
as a thickener, or a mixture of these, between 1 and 15 wt% of a first inorganic
filler with a specific gravity of less than about 1.5, between 10 and 50 wt% of a
10 second inorganic filler, between 15 and 45 wt% of a fiber-type reinforcing agent,
between 0.5 and 35 wt% of a low molecular weight polymerizable compound,
between 0.01 and 2 wt% of an initiator, and between 0.1 and 5 wt% of a parting
agent;

15 placing the composite sheet in a mold adapted for a sheet-molding-
compound-pressure-forming process;

applying a compacting pressure, wherein the compacting pressure is 30
kgf per square centimeter or less; and

curing the formed product.

20 20. The method of claim 19 wherein the first inorganic filler comprises hollow
glass spheres that have a specific gravity of between about 0.1 and 0.8;

the low molecular weight polymerizable compound comprises
monomers of styrene, methyl methacrylate, divinyl benzene, α -methyl styrene,
vinyl acetate, acrylate, or mixtures thereof;

25 the second inorganic filler comprises calcium carbonate, mica, talc and
clay;

the fiber-type reinforcing agent comprises glass fibers with a length less
than about 10 mm in length and is present in an amount between 20 and 35
wt%;

30 the parting agent comprises zinc stearate or calcium stearate; and

wherein the bulk density of the reacted composition is between about
1.3 and about 1.75.